

**Additional Range Extension by the German Yellowjacket,
Paravespula germanica (Fabricius), in North America
(Hymenoptera: Vespidae)¹**

ROGER D. AKRE, CAROL RAMSAY, AL GRABLE,
CRAIG BAIRD, AND ALAN STANFORD

(RDA, CR) Department of Entomology, Washington State University, Pullman, Washington 99164-6432; (AG) Department of Biology, Walla Walla College, College Place, Washington 99324; (CB) Cooperative Extension, University of Idaho, Parma, Idaho 83660; (AS) Idaho State Department of Agriculture, 421 W. Sherman Ave., Nampa, Idaho 82627.

The German yellowjacket, *Paravespula germanica* (Fab.), has become established in many temperate areas of the world (Edwards, 1976; Brown, 1979; Smithers and Holloway, 1977, 1978; Olafsson, 1979; Chiappa et al., 1986; Magunacelaya et al., 1986a, 1986b), and it continues to become established in new areas as it moves west across North America (MacDonald et al., 1980; MacDonald and McDonald (sic), 1980; Dunn, 1980a, 1980b; Stanford, 1984). These latter reports showed emigrations of German yellowjacket into the West. In the Pacific Northwest it has become established in southern Idaho around Nampa, and is present in the Seattle, Washington area. It was also reported in Minneapolis/St. Paul, Minnesota and Winnipeg, Canada. In addition, these yellowjackets have invaded California. In 1985 these wasps were reported as nesting in the San Francisco Bay area with at least 3 suspected colonies (Gambino, 1987).

The German yellowjacket is noteworthy because it has a propensity to nest in man-made structures in North America. Also, colonies are frequently large and usually persist late into the fall. These characteristics bring these yellowjackets into close contact with humans that often result in stinging episodes. German yellowjackets also have a tendency to become perennial, or at least to continue into a second year in warmer climates. Some colonies become huge with over a million cells in some nests in Tasmania, Australia (Spradbery, 1973; see also Edwards, 1980). This yellowjacket has apparently become the dominant species in some localities it has invaded (Stanford, 1984), and workers are very aggressive scavengers. The wasp is always perceived as a serious public health threat.

The purpose of this paper is to report additional range extensions of the German yellowjacket in North America, and make comparisons of biology and behavior with that of *Paravespula pensylvanica* (Saussure), the western yellowjacket.

PREVIOUS DISTRIBUTION IN NORTH AMERICA

We last reported *P. germanica* nests occurring in Nampa, Idaho in 1981 and workers in Puyallup, Washington in 1982 (MacDonald and Akre, 1984). The

¹ This work was conducted under project 0037, Washington State University, College of Agriculture and Home Economics.

western-most records of this wasp, into the Great Plains of North America, were at Minneapolis and Winnipeg. No colonies have been reported from anywhere in the South.

NEW DISTRIBUTION

It was inevitable that the German yellowjacket continue its spread westward. It continues to be the dominant yellowjacket in southern Idaho, and it is becoming more abundant in western Washington each year. Significant new distribution records (Fig. 1) of German yellowjacket presence and/or establishment, previously unreported, are listed briefly below:

Pacific Northwest

The first German yellowjacket nest found in Washington was located 4 August 1983 in a Puyallup home. The colony was killed but the nest was not accessible for collection.

In July 1984, the first workers were netted in British Columbia, Canada at Cloverdale (80 km W of Vancouver).

From August to December 1985, German yellowjacket nests were collected from houses in Seattle, Tacoma, and Chehalis, Washington.

In fall 1986, a colony with a nest of 91 cm × 46 cm was killed in a home in Clearbrook, British Columbia (near Vancouver).

In August and September 1986, the first workers were collected in Ontario and Nyssa, Oregon.

In October 1986, the first nest of the German yellowjacket was collected in Walla Walla, eastern Washington, located in a rotten stump of a willow tree.

In September 1987, the first nest was discovered in Oregon, in a house in Milton-Freewater.

* On 2 October 1988 a nest was collected in Prasser, Washington, and on 2 November 1988 a nest was removed from a house in Yakima, Washington.

* As of November 1988 the wasp was established from Vancouver to Rosedale in the Skagit Valley.

Other Significant Occurrences in North America

German yellowjackets were first collected in St. Louis, Missouri in 1974, and they are now abundant in the St. Louis area (Hunt, 1988). They have not been collected from other areas.

In 1985 we received specimens of *P. germanica* workers from personnel at El Dorado County Vector Control, Department of Agriculture, that had been collected in 1983 from South Lake Tahoe, California. Perhaps this was an isolated incident as no additional wasp problems have occurred in this locality.

We found an active colony 7 December 1987, 14.5 km E of East Quincy, California (elev. ca. 1100 m), in the base of a tree stump. The temperature was about 4°C and snow was lying in patches on the ground, but workers were flying.

During the summer of 1987 the Parks and Recreation Department of Saskatoon, Saskatchewan received numerous complaints about yellowjackets, mainly due to German yellowjackets. Personnel located 6 nests, but all were in homes and the colonies were destroyed. No nests were collected for analysis. However, a sample

* Added at proof.

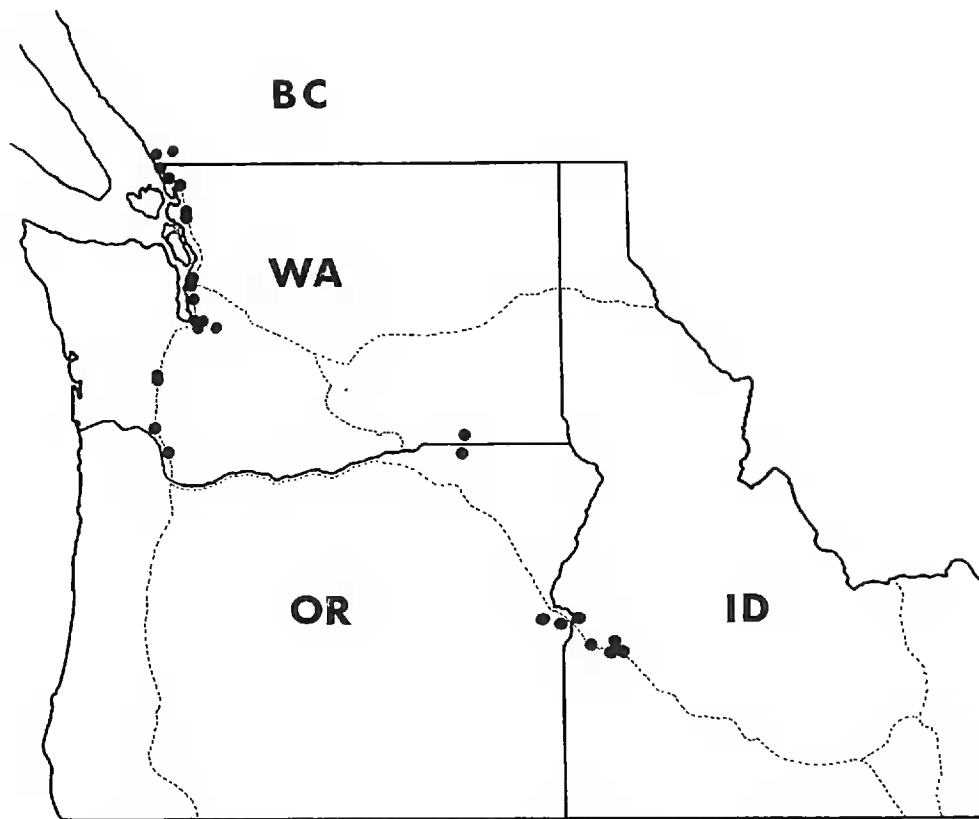


Figure 1. Known distribution of *Paravespula germanica* in the Pacific Northwest, with the interstate corridors noted by a dashed line.

of workers and males was sent to us in March 1987 for species verification. The presence of males indicated colonies were present in the city and reproducing. The Parks Department will expand a surveillance and monitoring project for this wasp in 1988 and 1989.

YELLOWJACKET TRAPPING

Trapping in Western Washington

Personnel at the State Department of Agriculture became concerned about the distribution of German yellowjacket in Washington during 1985, and during the summer of 1986 a trapping network was established to determine areas in western Washington where this yellowjacket was present.

Two hundred Seabright Yellowjacket Traps were deployed along Interstate 5 from the Oregon to Canadian borders. The traps were baited with either ham or pork sausage. All traps were checked and rebaited every 3 working days. Traps were monitored from 15 August through 21 October. All captured yellowjackets were placed in alcohol for subsequent determination.

The survey showed that German yellowjackets were present along the entire corridor (Fig. 1). However, apparently they were present only in low numbers since a total of only 233 workers was captured. The same traps caught 1582 *Paravespula vulgaris* (L.) and 1707 *P. pensylvanica* workers. Of course, it is possible that the baits or the traps were less effective at attracting or capturing *P. germanica* workers.

Trapping in Southern Idaho

As mentioned, the first German yellowjacket nest was collected in Idaho on 24 October 1981, and collections since this time indicated an ever increasing distribution (Stanford, 1984). Because of these discoveries, efforts were made in 1985

Table 1. Sites and nest sizes of analyzed *Paravespula germanica* nests in Washington, Oregon, and Idaho.

Location	Site	Number of cells
Bellingham, WA	attic	12,579
Renton, WA	ceiling	5251
Auburn, WA	ground	4186
Tacoma, WA	wall	4370
Pacific, WA	ceiling	1518
Puyallup, WA	eaves	13,748
Longview, WA	wall	3953
Longview, WA	ground	4955
College Place, WA	floor	4744
College Place, WA	wall	3153
College Place, WA	wall	10,461
College Place, WA	ground	6431
College Place, WA	crawl space	3980
Walla Walla, WA	basement	12,948
Milton-Freewater, OR	wall	13,654
Milton-Freewater, OR	attic	6353
Caldwell, ID	out building	7309
Nampa, ID	unknown	2078
Nampa, ID	crawl space	10,916

and 1986 to trap or net yellowjackets around Nampa to determine possible spread. Trapping was conducted with standard heptyl butyrate traps but with ginger ale as the attractant as meat baits were apparently not attractive. Netting was done by hand with an aerial net. Traps were placed at 13 sites in 1985 and 9 sites in 1986 on the perimeter of Nampa and Caldwell, Idaho, and along the Interstate 84 corridor from Boise, Idaho to Ontario, Oregon.

Trapping showed German yellowjackets were extremely common in Nampa, and are the dominant yellowjacket. However, the survey also showed that these wasps are present in Caldwell, Greenleaf, Wilder, Fruitland, and Parma, Idaho, and in both Nyssa and Ontario, Oregon. Essentially they are present along the entire corridor from Boise to just across the Oregon border. However, in 1985 the numbers trapped and netted were low, with 17 females trapped; 6 females netted. In 1986 low numbers were found again, with 34 females, 3 males trapped; 17 females netted. The period of collection during 1985 was 29 August to 8 November; during 1986–1987 this period was 22 August to 9 January.

NESTS

While many reports of German yellowjacket were submitted by county agents or provincial entomologists from western Washington and Canada, we have been able to obtain only a few nests for analysis. Usually colonies were killed and the nests destroyed. However, we collected or received information on 38 nests; 31 of these were built inside structures (Table 1). The other 7 nests were in the soil or stumps.

A comparison was made between German yellowjacket and western yellowjacket nests collected on about the same Julian dates but in different years. These data show German yellowjacket colonies are, in general, larger (Fig. 2). The analyses also showed that colonies of this species tend to persist later into the year (Fig.

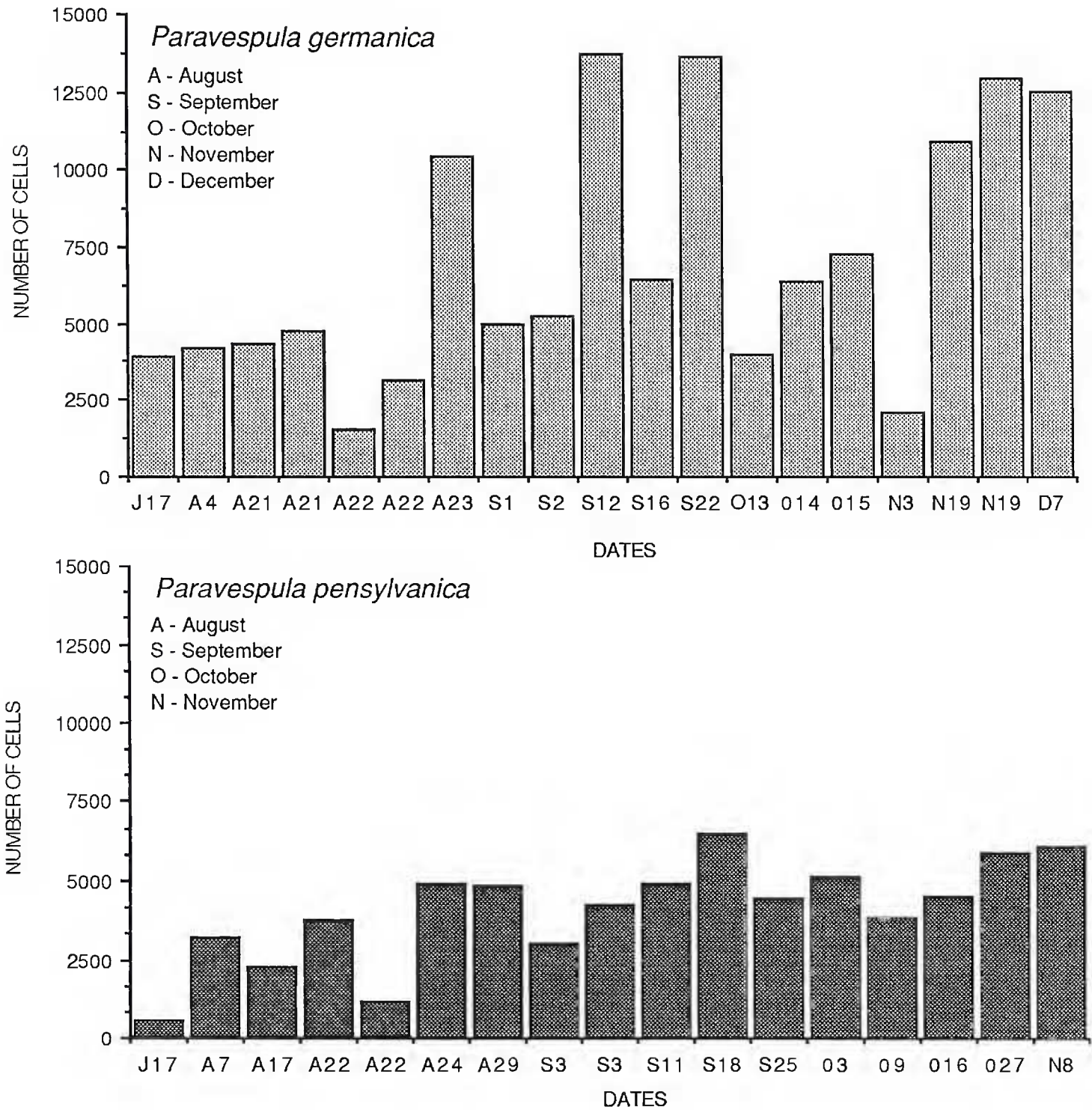


Figure 2. Comparison of nest size measured by cell numbers of *Paravespula germanica* and *P. pensylvanica*. *P. pensylvanica* data are from MacDonald et al. (1974).

3; Tables 2, 3). For example, presence of numerous empty cells or cells with multiple eggs (indicative of lack of queen control and the presence of egg laying workers, respectively) in nests of *P. germanica* occurred later into the year than in nests of *P. pensylvanica* (Tables 2, 3). Also in many cases the *P. germanica* foundress queen was still alive and functional later into the year (Table 2).

A serious problem in comparing nests of these two species is that all western yellowjacket nests were collected in the field under unaltered conditions. This is reflected in the relatively smooth increase in the size of the colonies (Fig. 2). Many German yellowjacket nests were collected from situations in which colony history was unknown. The data on colony size suggested that several colonies were treated with insecticides early in the development of the colony as the nests are unusually small for the dates of collection (Fig. 1, Table 2). All data on these nests should be considered with this potential problem in mind.

Similarity in colony sizes exists between *P. germanica* in North America and

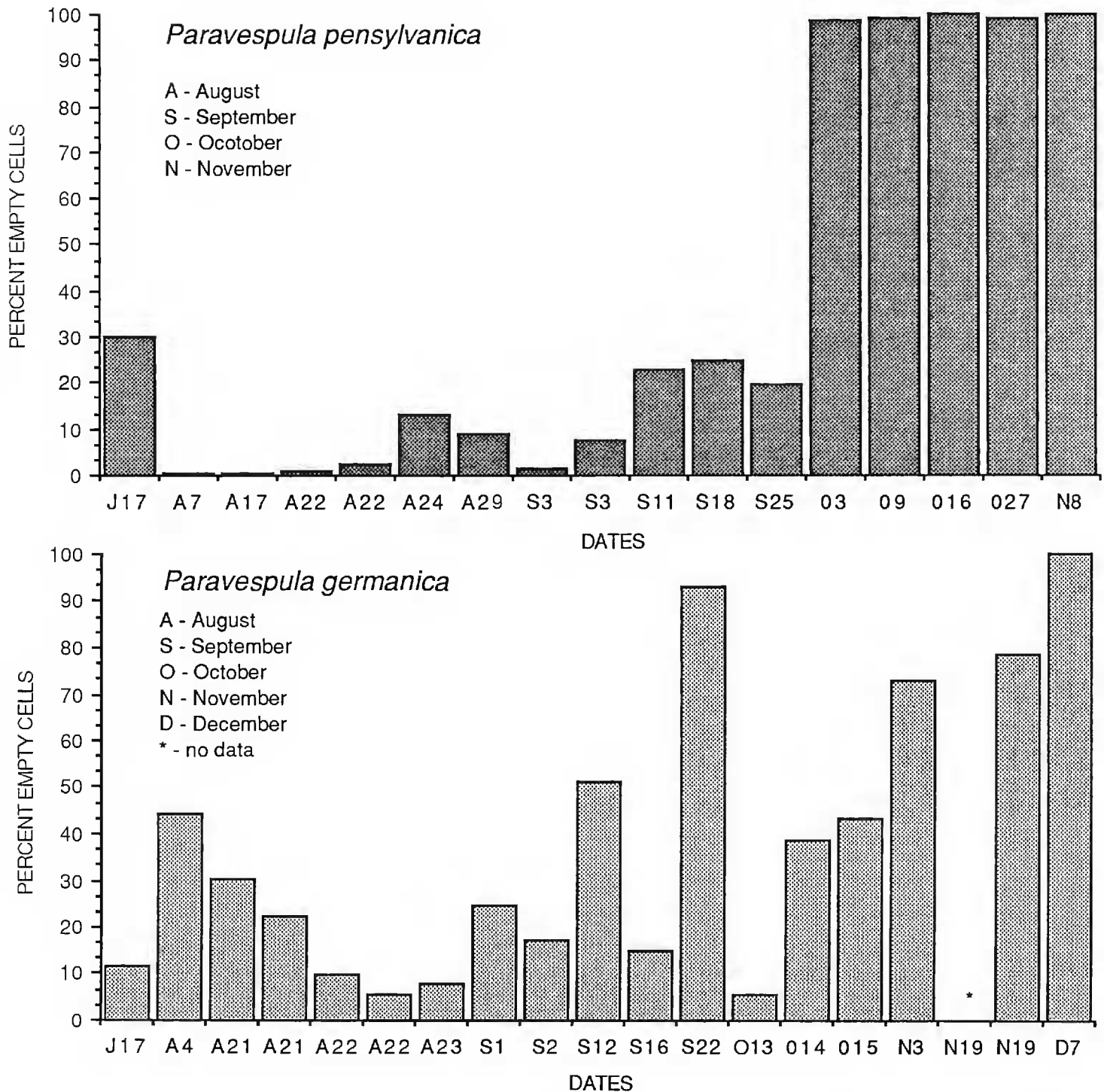


Figure 3. Comparison of number of empty cells in nests of *Paravespula germanica* and *P. pensylvanica*. *P. pensylvanica* data are from MacDonald et al. (1974).

Europe. Spradbery (1971) found a maximum of 12,000 cells per nest in England and Vasic (1968) cited a nest analyzed by Grozdanic (1965) with 12,632 cells per nest in Belgrade. This compares favorably to nests collected in Washington, 13,748 cells, Idaho, 10,916 cells, and Oregon, 13,654 cells. North American and European colonies are very small in comparison with those in the temperate maritime climatic regions where some nests contain more than a million cells (Spradbery, 1973). Nesting behavior of North American and European colonies also appears to be similar with nests occurring in structures and in the soil. However more colonies nest in structures in North America.

SEASONAL ACTIVITY

The seasonal activity of *P. germanica* and *P. pensylvanica* differs only in duration. Queens become active in the spring from early April to May, depending on weather, and forage for food and seek nest sites until late June. The first workers

Table 2. Analyses of 19 nests of *Paravespula germanica* from Washington, Idaho, and Oregon.

Location	Coll. date	Queen	Combs	Cells	Eggs	Larvae	Pupae	Empty cells (%)
Longview	17 July 1987	no	6	3953	303	799	2397	454 (11.5)
Auburn	4 Aug. 1985	?	6	4186	10	268	2057	1851 (44.2)
Tacoma	21 Aug. 1985	?	8	4370	522	662	1860	1326 (30.3)
Coll. Place ¹	21 Aug. 1987	yes	6	4744	272	866	2548	1058 (22.3)
Pacific	22 Aug. 1985	no	3	1518	233	415	721	149 (9.8)
Coll. Place	23 Aug. 1987	yes	5	3153	725	558	1701	169 (5.4)
Coll. Place ¹	23 Aug. 1987	yes	14	10,461	1535	3256	4856	814 (7.8)
Longview ¹	1 Sept. 1987	yes	6	4955	587	1257	1891	1220 (24.6)
Renton ¹	2 Sept. 1985	?	8	5251	762	1632	1957	900 (17.1)
Puyallup ¹	12 Sept. 1985	?	6	13,748	752 ²	2068	3091	7027 (51.1)
Coll. Place ¹	16 Sept. 1987	no	8	6431	482	1911	3075	963 (15.0)
Milton-Freewater ¹	22 Sept. 1987	?	17	13,654	0 ³	656	279	12,719 (93.2)
Coll. Place ¹	13 Oct. 1987	yes	6	3980	508	1516	1730	226 (5.7)
Milton-Freewater ¹	14 Oct. 1987	yes	6	6353	544	2740	630	2439 (38.4)
Caldwell ¹	15 Oct. 1986	?	10	7309	260	2109	1769	3171 (43.4)
Nampa ¹	3 Nov. 1983	?	5	2078	31 ²	208	324	1515 (72.9)
Nampa ¹	19 Nov. 1983	?	6	10,916	—	—	—	— —
Walla Walla ¹	19 Nov. 1987	no	6	12,948	274	2142	340	10,192 (78.7)
Bellingham ¹	7 Dec. 1987	no	8	12,579	0	0	0	12,579 (100)

¹ Colonies with reproductive cells.

² Colony with >4% multiple eggs per cell (all others <1%), suggesting queen had died.

³ Colony collected 1 mo after killed, eggs probably too dry to identify.

— No data taken.

Table 3. Analyses of 17 nests of *Paravespula pensylvanica* from Washington (MacDonald et al., 1974).

Location	Coll. date ¹	Combs	Cells	Eggs	Larvae	Pupae	Empty cells (%)
Pullman	17 July 1973	3	563	188	179	179	17 (30.0)
Pullman	7 Aug. 1973	5	3215	694	1373	1135	13 (0.4)
Pullman	17 Aug. 1973	4	2230	439	952	827	12 (0.5)
Pullman	22 Aug. 1973	4	3801	725	1509	1537	30 (0.8)
Pullman	22 Aug. 1973	4	1147	250	499	369	29 (2.5)
Pullman ²	24 Aug. 1973	5	4935	661	1842	1790	642 (13.0)
Pullman ²	29 Aug. 1973	5	4866	747	2014	1674	431 (8.9)
Pullman ²	3 Sept. 1973	5	3002	625	1324	1006	47 (1.6)
Pullman ²	3 Sept. 1973	6	4275	712	1846	1406	311 (7.3)
Pullman ²	11 Sept. 1973	5	4291	649	1688	976	978 (22.8)
Pullman ²	18 Sept. 1973	7	6489	741	2741	1394	1613 (24.9)
Pullman ²	25 Sept. 1973	6	4447	460	2004	1097	886 (19.9)
Pullman ²	3 Oct. 1973	7	5159	9	0	55	5095 (98.8)
Pullman ²	9 Oct. 1973	7	3869	0	0	40	3829 (99.0)
Pullman ²	16 Oct. 1973	6	4499	0	0	10	4489 (99.8)
Pullman ²	27 Oct. 1972	7	5891	0	0	47	5844 (99.2)
Pullman ²	8 Nov. 1972 ¹	7	6128	0	0	0	6128 (100)

¹ Only one colony available in November and no colonies were available in December.

² Colonies with reproductive cells.

of the western yellowjacket appear about 10 June in Pullman, Washington, while the earliest records of German yellowjacket workers indicate this species may be a bit later, in mid-late July. However, it is more probable that this late appearance of workers is simply due to a lack of collection records early in the season when workers are few in number. Colony longevity, however, seems to differ markedly as we received a few reports of German yellowjacket workers still very active and flying late in the fall and winter, with one case in Marysville, Washington with workers still active into February. This colony was in the wall of an unheated garage. In addition, two colonies were still active in Eagle, Idaho, 22 km NE of Nampa, in January 1987. One colony was in the attic of a house and the other in the wall of a barn. The maximum life span of western yellowjacket colonies is 7 mo, compared to the German yellowjacket which survives up to 11 mo.

Males and new queens of *P. pensylvanica* are active late September–October, infrequently into early November. Queens of *P. germanica* are active from October into early January.

SUMMARY AND DISCUSSION

Analyses of nests of the German yellowjacket show colonies are similar to those found in Europe, but are considerably larger than typical western yellowjacket colonies, and they persist later into the year. Since food resources become sparse later in the year, there is a tendency for these wasps to be in contact with humans for a longer period of time. Their propensity for nesting in structures also adds to greater human contact.

We anticipate the German yellowjacket will continue to expand its range into nearly all of western North America, and will become the dominant, scavenging yellowjacket in many of these areas. No information was available about German

yellowjacket in eastern or northern Oregon. However, it is assumed that they are present. Problems arise in determining range extensions when similar species are present, because many people do not realize that a new species has become established. Although interactions between *P. germanica* and *P. pensylvanica* are essentially unknown, within 2–5 yr of becoming established in an area, *P. germanica* apparently out-competes western yellowjackets to become dominant in numbers of workers and colonies. Also, the mild climate in parts of the Pacific Northwest might be amenable to colonies surviving more than one season. However, while we have received reports of at least 3 large nests that reportedly lasted more than a year, we have been unable to verify these accounts.

The sympatric existence of these two species in many localities of North America presents a unique opportunity to study the behavioral interactions of two very closely related species. It would not be at all surprising if they would eventually mate to produce a hybrid. However, in most areas mating is most likely improbable since male and queen production by the German yellowjacket is later in the year. Conversely, there is some overlap in reproductive production of colonies, and eventually hybridization is a possibility.

ACKNOWLEDGMENTS

We are indebted to a number of people who collected information, specimens, and nests of German yellowjackets for the project. We sincerely thank Art Antonelli, Sharon Collman, Henry Gerber, Lyle Klostermeyer, Eric LaGasa, Carl Roush, and Robert Stidham for their efforts. Richard Zack and Dan Suomi are thanked for critically reading the manuscript and for making suggestions for improvement.

LITERATURE CITED

- Brown, G. R. 1979. The European wasp is a potentially dangerous import. *Agric. Gaz. New South Wales* 90(5) reprint AGdex 612.
- Chiappa, E. T., J. C. Magunacelaya, and H. R. Jopia. 1986. Observaciones sobre el nido de *Vespula germanica* (Fab.) (Hymenoptera: Vespidae), en la zona de Chile. *Rev. Chilena Ent.*, 13:85–94.
- Dunn, G. A. 1980a. The introduced yellowjacket in Michigan. *Newsletter Mich. Ent. Soc.*, 25:1, 3.
- . 1980b. The introduced yellowjacket *Vespula germanica* (Fabricius) in Michigan and northern Indiana (Hymenoptera: Vespidae). *Insect and Nematode Special Rept. Coop. Ext. Ser. Mich. State Univ.* No. 80-6, 11 pp.
- Edwards, R. 1976. The world distribution pattern of the German wasp, *Paravespula germanica* (Hymenoptera: Vespidae). *Ent. Germanica*, 3:269–271.
- . 1980. *Social wasps: their biology and control*. Rentokil, Sussex, England, 398 pp.
- Gambino, P. 1987. First records of the German yellowjacket *Paravespula germanica* (L.) from the East San Francisco Bay (California, USA) area. *Pan-Pac. Ent.*, 63(4):358.
- Grozdanic, S. 1965. Some moments from the instinctive life of social wasps *Vespa crabro* L. and *Vespa germanica*. *Glasnik Prirodnjackog muzeja (Beograd)* B, 20.
- Hunt, J. 1989. The yellowjackets of Missouri. *Univ. of Missouri Coop. Extension EB*, In press.
- MacDonald, J. F., and R. D. Akre. 1984. Range extension and emergence of subterranean nesting by the German yellowjacket, *Vespula germanica*, in North America (Hymenoptera: Vespidae). *Ent. News*, 95(1):5–8.
- , ———, and R. E. Keyel. 1980. The German yellowjacket (*Vespula germanica*) problem in the United States (Hymenoptera: Vespidae). *Ent. Soc. Amer. Bull.*, 26(4):436–442.
- , and J. A. McDonald (sic, MacDonald). 1980. The German yellowjacket: a recent immigrant to Indiana. *Outdoor Indiana*, 45(9):16–22.
- Magunacelaya, J. C., E. Chiappa, H. Toro, and P. Guerrero. 1986a. Observaciones preliminares sobre

- la alimentacion de *Vespula germanica* (F.) (Hymenoptera: Vespidae), en la zona central de Chile. Rev. Chilena Ent., 13:55-58.
- , ———, ———, and R. S. Jubal. 1986b. Observaciones sobre comportamiento y alimentacion de *Vespula germanica* (Fab.) (Hymenoptera: Vespidae), en la zona central de Chile. Chile. Rev. Chilena Ent., 14:87-93.
- Olafsson, E. 1979. Um geitunga (Hymenoptera: Vespidae) og skyldar gaddvespur a Islandi. Natturfræðingurinn, 49:27-40.
- Smithers, C. N., and G. A. Holloway. 1977. Recent specimens of *Vespula* (*Paravespula*) *germanica* (Fabricius) (Hymenoptera: Vespidae) taken in Sydney. Aust. Entomol. Mag., 4:75-76.
- , and ———. 1978. Establishment of *Vespula germanica* (Fabricius) (Hymenoptera: Vespidae) in New South Wales. Aust. Entomol. Mag., 5(3):55-60.
- Spradbery, J. P. 1971. Seasonal changes in the population structure of wasp colonies (Hymenoptera: Vespidae). J. Anim. Ecol., 40:501-523.
- . 1973. The European social wasp *Paravespula germanica* (F.) (Hymenoptera: Vespidae) in Tasmania, Australia. Int. Union Study Soc. Insects VII Int. Cong. Proc., 7:375-380.
- Stanford, A. E. 1984. Dispersal and behavior of the introduced yellowjacket, *Paravespula germanica* (Fab.) (Hymenoptera: Vespidae) in and around Nampa, Idaho. Proc. Wash. St. Ent. Soc., 45: 659-664.
- Vasic, Z. 1968. Biological investigations on the German wasp (*Vespa germanica* F.). Bull. Nat. Hist. Mus., Belgrade Ser. B., 23:211-224.